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PROBLEMS AND SOLUTIONS.

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PROBLEMS FOR SOLUTION.

[N.B. The editorial work of this department would be greatly facilitated if, on sending in problems, the proposers would also enclose their solutions—*when they have them*. If a problem proposed is not original the proposer is requested *invariably* to state the fact and to give an exact reference to the source.]

2883. Proposed by ROBERT C. COLWELL, Geneva College, Beaver Falls, Pennsylvania.

Evaluate (a) $\int_0^\pi \cos^2 \left(\frac{n\pi \cos \theta}{2} \right) d\theta$ and (b) $\int_0^\pi \frac{\cos^m \theta d\theta}{\theta^n}$.

2884. Proposed by E. H. MOORE, University of Chicago.

Consider an $m \times n$ array A of numbers a_{st} and an $n \times m$ array B of numbers b_{ts} . Show that the system of mn equations:

$$\sum_{tu} a_{st} b_{tu} a_{uv} = 0 \quad (sv),$$

implies the equation:

$$\sum_{ts} a_{st} b_{ts} = 0.$$

The suffixes s, u have the range 1, 2, \dots, m and the suffixes t, v have the range 1, 2, \dots, n .

2885.

If A, B, C, X, Y are given collinear points, construct Z so that $\{ABCX\} + \{ABCY\} = \{ABCZ\}$, where $\{ABCX\}$ denotes the cross-ratio of the points A, B, C, X . [From the *Math. Tripos Exam.*, Cambridge, Eng., 1905.]

2886. Proposed by S. A. COREY, Des Moines, Iowa.

If, in considering the purchase of bonds in the open market, x = interest yield to investor; i = interest rate named in bond; t = time in years to maturity; and q = quoted market price, the relation between these quantities is expressed by the equation, $xq - (x - i)(1 + x)^{-t} - i = 0$. Find value of x .

Also show that, if $a = i/q + (1 - q)/qt$, we may, in practice, safely assume that very nearly,

$$x = \frac{at(a - i) + i[(1 + a)^{t+1} - (1 + a)]}{q(1 + a)^{t+1} + t(a - i) - (1 + a)}.$$

2887. Proposed by the late L. G. WELD.

A carpenter's square moves with its outer edges in contact with two round pegs of given equal diameters. Define the locus of the "heel" of the square.

2888. Proposed by J. A. BULLARD, U. S. Naval Academy.

Discuss the surface, $x^{1/2} + y^{1/2} + z^{1/2} = a^{1/2}$, by means of plane sections. (Cf. problem 2846, 1920, 326.)

2889. Proposed by W. D. LAMBERT, U. S. Coast and Geodetic Survey.

Evaluate, $\int_c^1 \frac{\cos^{-1} x dx}{\sqrt{x^2 - c^2}}$, where $0 < c < 1$.